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9.0 CONTAMINATED SITES MANAGEMENT

9.1 INTRODUCTION

The Project will develop, establish and maintain a Contaminated Sites Management (CSM) Program. The purpose of the CSM Program is to establish the criteria and methodologies to manage potential encounters with the existing known or unknown contaminated sites that occur within the right-of-ways of the Alaska segment of the Alaska Natural Gas Transportation System (ANGTS). The existing known and unknown contaminated sites within the Project right-of-ways are the responsibility of the landowner(s).

The Project will prepare a CSM Plan that will serve as a guide to the implementation of the CSM Program through coordination with the Technical and other Environmental Protection Programs through all phases of the Project.

This section provides background information related to contaminated sites along the proposed route that are the result of historical releases of petroleum, oils, lubricants or other hazardous substances. The need for a contaminated sites program arises from the proximity of the proposed route to existing and decommissioned petroleum facilities with documented fuel releases. Encounters with petroleum impacted soil and groundwater will require special procedures during excavation, dewatering, and spoils handling. In addition, construction or use of permanent and temporary facilities may involve encounters with contaminated sites.

The majority of the proposed pipeline route is located in the vicinity of existing pipeline facilities and transportation corridors with documented petroleum impacted soil and groundwater. The proposed ANGTS segment between the North Slope and Delta Junction generally follows the Dalton Highway and the Richardson Highway in close proximity to the Trans-Alaska Pipeline System (TAPS). The ANGTS segment between Delta Junction and the Canadian border generally follows the Alaska Highway within the right-of-way (ROW) of a decommissioned World War II-era pipeline that carried jet fuel from Haines to Fairbanks. In addition, ANGTS may reuse former TAPS or other construction-era camps for construction of ANGTS.

9.1.1 TAPS Corridor Summary

The northern section of the proposed ANGTS pipeline between the North Slope and Fairbanks will likely pass through several documented petroleum impacted areas resulting from the construction and operation of TAPS. Several crude oil or refined oil product releases related to TAPS construction and operation have been documented between 1972 and 2000 (Williams 2002). These releases occurred along the TAPS work pads, at pump stations, or along roadways in the vicinity of TAPS. Many of these spills were larger than 1,000 gallons and are therefore of greater interest for this project. Smaller or “deminimus” volume spills are not likely to impact construction operations significantly even if encountered, so statistics on these smaller spills are not relevant. A summary of these spills is included as Attachment 9.A.

9.1.2 Construction Era Camps

Construction and operation of the ANGTS pipeline may require the use of construction camps with documented petroleum impacted soil and groundwater. Several of the TAPS construction-era campsites are ideally located to support construction operations for this project. Several of these sites were contaminated as a result of historic releases, and use of these sites may require implementation of special procedures to address historic contamination if excavation activities occur on the pad.

9.1.3 Alaska Highway Summary

The southern section of the proposed ANGTS pipeline between Delta Junction and the Alaska-Canada border will also pass through several documented petroleum impacted areas resulting from the operation of the World War II – era Haines to Fairbanks jet fuel pipeline. A number of historic spills are documented, and it is possible other spill sites are located along the abandoned fuel pipeline. Attachment 9.B summarizes spill history information for the Haines pipeline. The proposed pipeline alignment for the Project is in close proximity to and crosses over the footprint of the abandoned fuel pipeline, such that the potential for encountering contaminated soil and/or groundwater along this route is high.

9.2 CRITERIA

9.2.1 General Project Criteria

- Any contamination of sites within the Project right-of-way that exists as of the effective date of right-of-way lease, whether previously known or unknown, on sites is the responsibility of the State.
- The Project does not accept or assume responsibility or liability for any contamination, known or unknown, existing s of the effective date of the Project's right-of-way lease at any sites within the Project right-of-way through the acknowledgment of the presence of such contamination, the authorized use of the right-of-way, or the authorized handling, including storage or disposal, of contaminated media within the right-of-way to accomplish Project construction and operation.
- The Project Sponsors will seek as part of the lease a provision that the State will not seek to impose any such responsibility or liability upon the Project.
- The Project Sponsors will seek as part of the lease a provision pursuant to which the State will indemnify, defend, and hold harmless the Project against any liability arising from any contamination, known and unknown, existing as of the effective date of the Project's right-of-way lease at any sites within the Project right-of-way.

9.2.2 Statutes, Regulations and Other Applicable Authorities

- 18 AAC 75 – ADEC Contaminated Sites Regulations

- 18 AAC 70 – ADEC Water Quality Regulations
- 18 CFR 380.12, "FERC's Environmental Reports for Natural Gas Act Applications," and FERC environmental policy guidelines thereunder;
- Federal Right-of-Way Grant for the Alaska Natural Gas Transportation System Alaska Segment, Serial No. F-24538 (December 1, 1980), as such may be updated and/or amended from time to time.
- Federal Energy Regulatory Commission conditional certificate of public convenience and necessity, issued on December 16, 1977, as such is finalized.
- EPA Guidance for Managing Contaminated Soils During Construction Activities

9.3 METHODOLOGIES

The Project will develop a Contaminated Sites Management Plan (CSMP) that identifies the specific criteria and methodologies for managing contaminated sites. The Project will coordinate with the Alaska Department of Environmental Conservation (ADEC) and the Alaska Department of Natural Resources (ADNR) in the development of the CSMP.

The methodologies presented in the CSMP will include the planning and identification required for expected encounters with contaminated media. The CSMP will include the notification, handling, and documenting procedures for both expected and unexpected encounters with contaminated media.

The Project will develop the following figures for the CSMP:

- Locations of construction-era camps, TAPS, jet fuel pipeline relative to proposed ANGTS route.
- Locations of major known spill sites along the proposed route. Provide a legend to show categories such as: 1) crude oil spills >1,000 gallons; 2) crude oil spills >10,000 gallons; 3) refined product spills >1,000 gallons; 4) refined product spills >10,000 gallons.
- Adapt a figure showing the construction-era camp contamination rating scores.

The Project will develop the following tables for the CSMP:

- Summary of TAPS Construction-era campsites: CS-related work performed to date; regulatory status from a CS perspective; and other relevant information.
- Summary of known spill sites along the Haines jet fuel pipeline route to provide a sense for the volume and age of spills along this segment of route.

9.3.1 Planning

The planning stage of the CSMP will include the development of efficient methods for managing encounters with contaminated sites. The planning stage will also consider avoidance of encounters with contaminated sites through route selection. The CSMP will include plans for coordinating the handling of the contaminated media with the responsible party and the

landowner. The CSMP will identify the equipment and resources available at the construction site to contain contaminants during the handling of contaminated media. The CSMP will also develop the procedures for addressing the health and safety concerns inherent in operations dealing with petroleum contaminated soil and groundwater.

9.3.1.1 Coordination with Land Owners & Responsible Parties

The CSM Plan will describe the procedures for coordination with public and private landowners and parties that have been previously identified as potentially responsible parties.

9.3.1.2 Worker Health & Safety

The CMS Plan will describe procedures for protection of the health and safety of Project workers and others involved with the Project that could potentially become exposed to contaminated media.

9.3.2 Identification

The CSM Plan will provide procedures for identifying contaminated sites at locations where avoidance of the contaminated site is not practicable, or where contaminated sites are encountered unexpectedly. The CSMP will describe the characteristics of contaminated sites and the field tests required to confirm the presence of petroleum contamination. Field screening frequency will be established for locations where encounters are not expected including increases for locations where encounters are anticipated.

9.3.3 Notification

The CSMP will present the notification requirements for encounters with contaminated sites. Procedures will be established for notifying the appropriate regulatory agencies (including ADEC) in the required timeframe, as well as the responsible party and the landowner. The appropriate contact names and numbers will be included to facilitate notification.

9.3.4 Handling

The CSMP will describe the methodologies for handling contaminated soil and groundwater during excavating, stockpiling, and dewatering work. These will include the methods for segregating contaminated soil into separate stockpiles, the collection of laboratory samples from the stockpiles and the excavation, and the construction requirements for soil stockpiles. The modifications will include the methods for managing contaminated groundwater entering the excavations. Methods for disposal or re-use of the contaminated media will be established.

9.3.5 Documentation

The final component of the CSMP will be the development of documentation methods for encounters with contaminated sites. The CSMP will describe the analytical testing program that will be used including the specific field and laboratory tests and quality assurance/quality control procedures. The methods for documenting the nature of the contamination, the locations and contaminants encountered will be described in the CSMP.

9.4 FIGURES AND TABLES

(None)

9.5 BIBLIOGRAPHY

Alaska Department of Environmental Conservation (ADEC). 2002. Contaminated Sites Remediation Program, Division of Spill Prevention and Response. Web Site: http://www.state.ak.us/dec/dspar/csites/index.htm.

Williams, Debra. 2002. Conversation with C. Black, OASIS Environmental, Inc. regarding Freedom of Information Act (FOIA) request for Contaminated Sites Database information for the TAPS corridor and Alaska Highway corridor. March 27. (Comments: database will be generated and provided to OASIS).

Rickard, W.E. and F. Deneke. 1972. Preliminary investigations of petroleum spillage, Haines-Fairbanks military pipeline, Alaska. Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire. (This paper describes the results of investigations performed at 28 known pipeline cuts that were done to remove ice caused by incomplete purging of hydrostatic test water

9.6 ATTACHMENTS

Attachment 9.A - Preliminary List of "Active High Priority" Contaminated Sites In the Vicinity of the Project Obtained From the Alaska Department of Environmental Conservation in March, 2002.
Attachment 9.B - Preliminary Investigations of Petroleum Spillage, Haines-Fairbanks Military Pipeline, Alaska (Rickard, W.E. and F. Deneke, 1972).

Attachment 9.A

Preliminary List of Active High Priority Contaminated Sites In the Vicinity of the Project Obtained From the Alaska Department of Environmental Conservation in March, 2002.

Active High Priority Contaminated Sites in the Vicinity of the Project (From ADEC, March 2002)

Facility Common Name	Site Street	Site Street2	Site City	ZipCode	DEC File Number	Staff Name	Problem Statement
|Air Force Base Anti-Aircraft Site|	|Eielson Farm Road|		|Eielson AFB|	|99702|	|107.38.095|	|Farris|	|The site was a former anti-aircraft artillery (AAA) site in the cold war era. Site consisted of 9 bunkers constructed primarily of empty drums, 15 concrete foundations, a UST, and some type of septic well. There is evidence of extensive buried drums that may be the source for the free-phase (roughly 4 acres) and dissolved (roughly 15-acre) groundwater plumes. Sheen noticed on surface water pond and a seep exists from the soil. The site is located off the Eielson Farm Road in a rural residential area. Drinking water wells are within a mile downgradient of the site.|
|Air Force Base Asphalt Mixing Area|	|Asphalt Mixing Area|		|Eielson AFB|	|99702|	|107.38.018|	|Farris|	|Mixing area for asphalt and base for road oiling operation; commingled waste oils and solvents mixed with contaminated fuels; possible disposal of 200 empty asphalt drums at site.|
|Air Force Base Bakery/Boiler House|	|Building 3224|	|Central Av, S of Division|	|Eielson AFB|	|99702|	|107.38.067|	|Farris|	|Diesel fuel floating on water table; possibly released from spills and leaks from tanks at former bakery or former boiler house. Lead found in the surface soil (8 to 95 mg/kg), but was attributed to vehicle traffic|
|Air Force Base Construction Site|	|Bldgs 3405,3409,3411,3386|	|adj to power plant ST48|	|Eielson AFB|	|99702|	|107.38.084|	|Farris|	|Diesel fuel floating in 8 foot deep holes dug during construction activities; possibly from older boiler plant (Building 3405), which reportedly had a cesspool and drywell associated with it. Buildings 3409 and 3411 contain backup generators with 2, 25,000-gallon USTs. Building 3386 is an equipment laboratory.|
|Air Force Base Ditch|	|Between Gen. Bldg. & Pump|		|Eielson AFB|	|99702|	|107.38.073|	|Farris|	|Diesel fuel from unknown source floating as 1/2 inch layer in ditch.|
|Air Force Base Former Research Fac.|	|14 Mile Transmitter Road|	|Building 500|	|Eielson AFB|	|99702|	|107.38.096|	|Farris|	|AKA Building 500-formerly used as a cold war data receiving/transmitting station and control center for Atomic Energy Detection System and abandoned ca. 1980. PCBs and fuels were disposed. Surface soil PCB contamination is present near the concrete pads adjacent to the building and the manmade pond south of the building is impacted by fuel contamination. An UST of unknown size served diesel generators at the building. Extent of contamination unknown.|
|Air Force Base Fuel Hydrant System|	|Flightline|		|Eielson AFB|	|99702|	|107.38.066|	|Farris|	|Diesel and MOGAS from ruptured, leaking, or overfilled fuel bladders at E-4 refueling/defueling area.|
|Air Force Base Fuel Line Spill Area|	|Cargain Road|	|Near the Taxiway Loop|	|Eielson AFB|	|99702|	|107.38.068|	|Farris|	|JP-4 fuel release of 200,000 gallon during fuel line rupture in the 1950's. Second spill in 1994 of over 15,000-gallons of JP-8. Fuel line is out of service (drained and capped) now. Free product plume was delineated in 1994 by CRREL to cover an approximate area of 125,600 square feet and the benzene dissolved plume to extend 400 ft to the north of the product plume.|
|Air Force Base Fuel Pit|	|Cargain Road|		|Eielson AFB|	|99702|	|107.38.068|	|Farris|	|Unknown quantity spilled. As of 1/20/95, they had recovered 14,700 gallons of JP-8 from the concrete sump. Microwells were installed and a plume was delineated. See file for more information.|
|Air Force Base Fuel Tank Sludge Pit|			|Eielson AFB|	|99702|	|107.38.023|	|Farris|	|Fuel with significant concentrations of sludge from periodic fuel storage tank cleaning, buried in shallow trenches.|
|Air Force Base Fuel Tank Sludge Pit|	|Flightline & Hazmat Yard|		|Eielson AFB|	|99702|	|107.38.024|	|Farris|	|Fuel in weathered sludge from periodic fuel storage tank cleaning, buried in pit.|
|Air Force Base Gas Station|	|Building 2375|		|Eielson AFB|	|99702|	|107.26.002|	|Farris|	|10,000 gallon super unleaded gas tank failed Tracer Tight Test - 4/23/91, 5/8/91 and 8/22/91.|
|Air Force Base Landfill & EOD Area|	|?|		|Eielson AFB|	|99702|	|107.38.030|	|Farris|	|General refuse and possibly small quantities of waste oil, spent solvents, munitions, and spent cartridges received by old landfill; current munitons disposal and explosives detonation area.|
|Air Force Base Leach Field Building|	|Near Building 1140|		|Eielson AFB|	|99702|	|107.38.021|	|Farris|	|Battery shop solvents possibly drained to leach fields.|
|Air Force Base Maint./Generator|	|Diesel Storage Tank 1|		|Eielson AFB|	|99702|	|107.38.074|	|Farris|	|Diesel fuel spill from failure of 1-1/4 inch pipe connecting main diesel fuel storage tanks to 550 gallons above ground day tanks near vehical maintenance building and generator facility.|

Facility Common Name	Site Street	Site Street2	Site City	ZipCode	DEC File Number	Staff Name	Problem Statement
|Air Force Base Old Service Station|			|Eielson AFB|	|99702|	|107.38.058|	|Farris|	|Possible releases from aboveground tanks.|
|Air Force Base Photo Lab|			|Eielson AFB|	|99702|	|107.38.022|	|Farris|	|Photo chemical discharged to dry well; trichloroethene, benzene, and other solvents present in nearby groundwater.|
|Air Force Base POL Storage|	|POL Storage|		|Eielson AFB|	|99702|	|107.38.064|	|Farris|	|MOGAS leaks from storage tanks at the E-2 POL storage area; possible migration to POL Lake. Free-product on groundwater table.|
|Air Force Base Power Plant|	|Division & Industrial Sts|		|Eielson AFB|	|99702|	|107.38.070|	|Farris|	|Gasoline and diesel possibly from abandoned 3-inch pipelines near the Base power plant.|
|Air Force Base Sewage Treat. Plant|	|MP 26 Richardson Highway|	|Sewage Treatment Plant|	|Eielson AFB|	|99702|	|107.26.013|	|Farris|	|DEC informed on 9/13/91 that a site inspection confirmed a leaking diesel tank has caused gross contamination to groundwater, soil, and building foundation. Extent of contamiantion and threat to human health unknown.|
|Air Force Base Ski Lodge|			|Eielson AFB|	|99702|	|107.38.062|	|Farris|	|Area contains old fuel storage tank area; pit for disposal of contaminated fuel and sludge.|
|Air Force Base Slough|	|Hottest Spot is Behind|	|Civil Engineering Bldg.|	|Eielson AFB|	|99702|	|107.38.054|	|Farris|	|PCB contamination was found in sediment and soil in Garrison Slough as well as in fish. Contaminated groundwater and surface runoff from site. Garrison Slough is primary SW drainage through base.|
|Air Force Base Storage Area|	|Quarry Road|		|Eielson AFB|	|99702|	|107.38.065|	|Farris|	|JP-4 fuel spills during delivery of fuels along railroad line adjacent to E-2 POL Storage Area.|
|Air Force Base Vehicle Maintenance|	|Blair Lakes Facililty|		|Eielson AFB|	|99702|	|107.38.072|	|Farris|	|Heating oil spill at storage tank, and abandoned buried fuel lines. Near water well for Blair Lakes vehicle maintenance building. Floating product on groundwater|
|Air Force Base Vehicle Maintenance|			|Eielson AFB|	|99702|	|107.38.055|	|Farris|	|Oil from oil/water separator is released to leach field.|
|Air Force Dewline Site|	|50 Mi. NW of Prudhoe Bay|		|Prudhoe Bay (ne|	|99734|	|300.38.013|	|Farris|	|The old landfill received station wastes from 1956 to 1978. The extent of contamination is unknown.|
|Air Force Dewline Site|	|LF01|	|50 Mi. NW of Prudhoe Bay|	|Prudhoe Bay (ne|	|99734|	|300.38.013|	|Farris|	|The dates of operation and wastes discarded at the old dump site are unknown. In July 2001, it was discovered the landfill had eroded and debris was exposed. A sheen was noted on the water in a drainage channel adjacent to the dump site.|
|Air Force Dewline Site|	|Bullen Point|	|East of Flaxman Island|	|Prudhoe Bay (ne|	|99734|	|375.38.002|	|Farris|	|The site was in operation from 1956 to 1971. There was potential for fuel spills from the use of POL tanks. The extent of contamination is unknown.|
|Air Force Dewline Site|	|50 Mi. NW of Prudhoe Bay|		|Prudhoe Bay (ne|	|99734|	|300.38.013|	|Farris|	|Spills of arctic diesel fuel have occurred at the installation. The dates of the spills and the extent of contamination are unknown.|
|Air Force Dewline Site|	|50 Mi. NW of Prudhoe Bay|		|Prudhoe Bay (ne|	|99734|	|300.38.013|	|Farris|	|The gasoline storage area has been operated from 1956 to the present. Contaminants include fuels. The extent of contamination is unknown.|
|Air Force Dewline Site|	|50 Mi. NW of Prudhoe Bay|	|Beaufort Bay|	|Prudhoe Bay (ne|	|99734|	|300.38.013|	|Farris|	|Site operated 1953 to present. Possible contaminants include petroleum products, solvents, paint wastes. Extent of contamination unknown. 1987 up/downgradient water samples showed nothing above drinking water standards. No drinking water near site. Site cleaned of debris in 1978-1980.|
|Air Force Dewline Site|	|Bullen Point|	|East of Flaxman Island|	|Prudhoe Bay (ne|	|99734|	|375.38.002|	|Farris|	|Site operated 1956 to present. Site investigation found low levels of PCBs and low levels of TPH in soils. Surface water samples all non-detectable. Old landfill may be eroding into lagoon. Old POL fuel tanks may still have product. Removal action occurred in 1988. Extensive diesel range organic contamination in sediments found during construction project.|
|Air Force Dewline Site|	|Bullen Point|	|East of Flaxman Island|	|Prudhoe Bay (ne|	|99734|	|375.38.002|	|Farris|	|The old (east) landfill was operated from 1956 to 1971. The potential contaminants and extent of contamination are unknown.|

Facility Common Name	Site Street	Site Street2	Site City	ZipCode	DEC File Number	Staff Name	Problem Statement
|Air Force Station, Former|	|Murphy Dome|	|Murphy Dome Road|	|Fairbanks|	|99709|	|100.38.040|	|Buck|	|Landfill No. 2 was used by the Air Force from 1970 - 1978 for garbage disposal. 1993 sampling found lead concentrations exceeding RCRA regulated levels (one sample only). Additional site investigation planned for 1994.|
|Air Force Station|	|Murphy Dome Road|	|Murphy Dome|	|Fairbanks|	|99709|	|100.38.040|	|Buck|	|Waste Accumulation Area No. 2 was used to store drummed materials, primarily petroleum, from the 1950s until about 1970. Sampling found high levels of TPH and DRO near the site and 500 feet downslope from area. Additional investigation planned for 1994.|
|Air Force Station|	|Murphy Dome|	|Murphy Dome Road|	|Fairbanks|	|99709|	|100.38.040|	|Buck|	|Landfill No. 1 covers approximately 1 acre. ADEC has no permit for this landfill which was used about 1950 to 1969. In 1987 a cleanup was performed and 2 feet cover applied. Limited sampling detected DRO soil contamination. Additional site investigation 1994.|
|Air Force Station|	|Murphy Dome|	|Murphy Dome Road|	|Fairbanks|	|99709|	|100.38.040|	|Buck|	|Waste Accumulation Area No. 1 was used from 1970 - 1985 for drum storage. The former Bulk Fuel Storage Area consisted of 2 large ASTs. Two major fuel spills occurred (approximately 1970 and 1981). High levels of DRO detected downslope from area and surface water samples contain DRO, BTEX, chlorinated solvents, and pesticides above regulatory levels. Several vegetation dead zones. Additional investigation planned for 1994.|
|Air Force Station|	|Murphy Dome|	|Murphy Dome Road|	|Fairbanks|	|99709|	|100.26.087|	|Buck|	|In 1991 DEC was informed that a 2,000-gallon diesel fuel UST was located near Building 1001, the old White Alice Building. In 1993 the UST was removed and approximately 400 cubic yards of diesel soil contamination noted. Additional site investigation to be conducted under IRP program.|
|Air Service Company|	|Deadhorse Airport|	|Lot 5, Block 303|	|Deadhorse|	|99734|	|300.38.022|	|Egbejimba|	|Initially reported as a tank overflow on 6/29/90, subsequent investigation determined that the spill was caused by an underground fuel line leak of Jet A fuel estimated at 500 gallons. No known drinking water sources within 1 mile. Excavation of soils began 7/7/90 and stockpiled on Lot 1A/1B, Block 304.|
|Army Base, Former, House Building|	|300' East of Robin Road|	|250' North of Post Road|	|Delta Jct. (nea|	|99737|	|141.38.036|	|Light|	|Diesel fuel detected in soil samples during BRAC site characterization.|
|Army Base, Former|	|~34 Miles East of|	|Delta Junction|	|Delta Jct. (nea|	|99737|	|141.38.039|	|Light|	|As early as 1959, an unknown quantity of chemical test equipment and munitions were disposed of in two pits, one near Blueberry Lake (dates unknown). Materials used on site included nerve gases, GB, VX, and HD (mustard gas); and a biological agent tolaremia. Extent of contamination and health impact unknown.|
|Army Base, Former|	|Next to Building 640|		|Delta Jct. (nea|	|99737|	|141.38.036|	|Light|	|Dioxins and metals found in soil samples during BRAC site characterization.|
|Automobile Repair Shop and Salvage|	|Hollowell Road|		|North Pole|	|99705|	|100.38.139|	|Johnson|	|Former auto shop and salvage yard. 200 square feet of stained soil, full and partial drums of petroleum products and waste oils, containers of mixed hazards such as paint, grease, and possibly solvents, as well as batteries and tires.|
|Aviation Navigation Facility|			|Northway|	|99764|	|170.26.007|	|Olson|	|Four 20K gallon diesel fuel tanks have contaminated approximately 150 cubic yards of soil each, totaling 600 cubic yards. Tanks and piping have been rremoved and the soil stockpiled.|
|Aviation Navigation Facility|			|Northway|	|99764|	|170.26.006|	|Olson|	|LUST leaked unk quantity of fuel oil from system reported on August 18, 1992.|
|Aviation Navigation Facility|	|?|		|Northway|	|99764|	|170.38.020|	|Olson|	|Significant soil contamination and Groundwater impacted. Contamination present at location of a previous diesel and gasoline tank removal. GW is impacted. Photo's and soil samples collected. Release Investigation underway.|
|Bulk Fuel Storage Facility|	|Jct. AK & Richarson Hwys.|		|Delta Jct.|	|99737|	|141.38.001|	|Light|	|Suspected spills, tank or piping leaks.|
|Bulk Fuel Storage Facility|	|1455 Richardson Highway|		|North Pole|	|99705|	|100.38.078|	|Bauer, D.|	|A large number of transformers and transformer carcasses stored at the site and surface contamination is evident. Approximately 80 drums of unknown substances observed in 8/89. Possibility of PCB contamination. Extent of contamination and health impacts unknown.|
|Crude Oil Pipeline Construct. Camp|	|Mile 334.4 Dalton Highway|	|80 Mi. South of Deadhorse|	|Prudhoe Bay (ne|	|99734|	|330.38.049|	|Williams|	|Multiple contaminants remaining from spills during operations of a pipeline construction camp. Soil, GW and SW contamination exists. Fresh water and wetlands present. Anadromous fish stream nearby.|
|Crude Oil Pipeline Construct. Camp|	|Mile 284.3 Dalton Highway|	|130 Mi. So. of Deadhorse|	|Prudhoe Bay (ne|	|99734|	|330.38.050|	|Williams|	|Contamination remaining from spills during operations of a pipeline construction camp. Soil, GW and SW contamination exists. Fresh water and wetlands present.|
|Crude Oil Pipeline Facility|	|Spine Road|	|Pipeline Mile 0|	|Deadhorse|	|99734|	|330.38.008|	|Williams|	|Alyeska conducted a pipe releveling and reinsulation project at Pump Station 1. As a result of this work over 10,000 cubic yards of therminol 44 contaminated gravel was excavated and stockpiled. Any soil with TPH concentration greater than 100 mg/kg was identified to be thermally remediated. Approximately 3200 cubic yards were identified for remediation.|

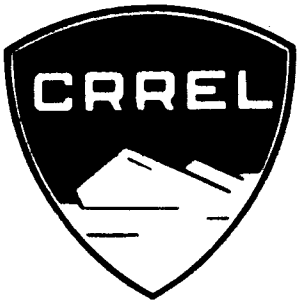
Facility Common Name	Site Street	Site Street2	Site City	ZipCode	DEC File Number	Staff Name	Problem Statement
|Crude Oil Pipeline Facility|	|Spine Road|	|Pipeline Mile 0|	|Deadhorse|	|99734|	|330.38.019|	|Williams|	|Above ground gas storage tank leaked approximately 112 gallons on 12/14/94. Subsequent soil samples collected in spring indicated gas range hydrocarbon contamination in soil and water. Several earlier spills in area.|
|Crude Oil Pipeline Facility|	|Mile 311.8 Dalton Highway|	|Pipeline Mile 104.3|	|Deadhorse (near|	|99734|	|330.38.005|	|Williams|	|Alyeska Pipeline Service Co. performed a SA of its fuel handling area at PS3. Soils contaminated with petroleum hydrocarbons were excavated and thermally incinerated. Groundwater contamination related to this spill. Philip Smith Mtns D-4 Quadrangle.|
|Crude Oil Pipeline Facility|	|701 Bidwill Avenue|		|Fairbanks|	|99701|	|102.38.044|	|Bauer, D.|	|Monitoring well samples collected in early 1990 have revealed high concentrations of chlorinated solvents present in the groundwater. The contamination plume is estimated to be 500' long and moving in a northerly direction. Presence of drinking wells in the area is unknown at this time.|
|Crude Oil Pipeline Facility|	|Fueling Area|	|Near Livengood|	|Minto (near|	|99758|	|330.38.074|	|Williams|	|Soil contamination was discovered at Pump Station 6 during a September 1992 upgrade project involving the installation of a lined spill containment cell beneath the turbine fuel loading area. Approximately 1,400 cubic yards of soil containing petroleum hydrocarbon concentrations exceeding ADEC target levels were excavated.|
|Crude Oil Pipeline Facility|	|Mile 55 Dalton Highway|	|Pump Station 6|	|Minto (near|	|99758|	|330.38.007|	|Williams|	|GRO, DRO and PAH contamination. In September of 1997, a site assessment was performed and found petroleum-contaminated soil and suprapermafrost groundwater. Three potential contaminant sources have been identified: 1) the fuel island, 2) the existing tank farm, and 3) the construction-era tank farm and generator buildings. The footprint of the petroleum-impacted area encompasses approximately 42,500 square feet and approximately 4,300 cubic yards of petroleum-impacted soil.|
|Crude Oil Pipeline Facility|	|Mile 218 Richardson Hwy.|	|Pump Station 10|	|Paxson (near)|	|99737|	|330.38.022|	|Williams|	|Large releases of crude oil in 1980, 1992 and numerous smaller spills within a large diked secondary containment area. No liner and groundwater contamination occurred.|
|Crude Oil Pipeline Facility|	|Mile 218 Richardson Hwy.|	|50 Mi. S. of Delta Jct.|	|Paxson (near)|	|99737|	|330.38.011|	|Williams|	|Alyeska Pipeline Service Co. performed a SA of the turbine fuel offloading area at PS10. 185 cubic yards of soils contaminated with petroleum hydrocarbons were excavated and were thermally remediated.|
|Crude Oil Refinery|	|1100 H & H Lane|		|North Pole|	|99705|		|Bauer, D.|	|Broken rail car armature resulted in estimated 300-gallon gasoline spill. Interim removal excavated 36 square feet to 1.5feet depth resulting in 10 barrels of impacted soil stored on-site. Lab analysis of composite soil sample from floor and walls of excavated area had 210mg/kg GRO.|
|Fuel Distributor and Shop|	|1995 Badger Road near|	|Jct With Holmes Road|	|North Pole (nea|	|99705|	|100.38.153|	|Bauer, D.|	|Soil and groundwater contamination from shop floor drain fed soil adsorption system (SAS) and minor spills at drum storage area. SAS and 100 cubic yards of DRO and RRO soils removed for thermal remediation.|
|Historic Dump Site|	|South Santa Claus Lane|	|and 5th Avenue|	|North Pole|	|99705|	|100.38.037|	|Conn|	|During the excavation for the new post office facility an old dumpsite was uncovered. 700 cubic yards of soil from this excavation was piled at the proposed site of a playground. Presence of contamination and extent is unknown.|
|Maint. Shop & Storage Area, Former|	|1101 Vicki Lane|	|P.O. Box 58288|	|North Pole|	|99705|	|100.38.127|	|Bauer, D.|	|Winnie Miller (current landowner) discovered and reported crushed buried drums on property. ADEC site inspection revealed an open injection well in shop building. ADEC confirmed petroleum discharge to soil at drum area and at injection well.|
|Maintenance Facility|	|Mile 138.1 Dalton Hwy.|		|Coldfoot (near)|	|99701|	|330.38.030|	|Pikul, D.|	|On October 27, 1994, DOT staff discovered 1050 gallons diesel fuel leaked from a faulty valve in Life Support Building. Diesel contamination of gravel pad and free product observed on ground water table at approximately 7' below surface. Diesel releases of 400 gallons on 1/11/95 and 2200 gallons on 1/18/96 add to the site.|
|Military Staging Area, Former|	|Mile 4 - 7 Northway Road|	|Northway Airport|	|Northway|	|99764|	|170.38.028|	|Caillouet|	|Approximately 50 POL barrels located at the west end of the runway and tar-contaminated soils are located east of the runway. Numerous reports of alleged petroleum and solvent spills that may have contaminated soil, ground and surface waters. The primary health concern is with water contamination, and presence of leaking storage tanks, their contents and condition unknown. A DDT/DDE source is suspected in the area due to low levels of DDE detected.|
|Military Staging Area, Former|	|Mile 4 - 7 Northway Road|	|Northway Airport|	|Northway|	|99764|	|170.38.028|	|Caillouet|	|Approximately 50 POL barrels located at the west end of the runway and tar-contaminated soils are located east of the runway. Numerous reports of alleged petroleum and solvent spills that may have contaminated soil, ground and surface waters. The primary health concern is with water contamination, and presence of leaking storage tanks, their contents and condition unknown. A DDT/DDE source is suspected in the area due to low levels of DDE detected.|
|Oilfield Service Company|	|Spine Road|	|Block 70, Lot 5A|	|Deadhorse|	|99734|	|300.38.025|	|Evans|	|Extensive area of an oil service gravel pad found to be contaminated with petroleum hydrocarbons, VOCs, trichlorofluoromethane, and possible gasoline 8/90. Lease area in use since 1982. Sheen in drainage ditch near lease site. TPH and xylenes found in adjacent tundra pond water. Rusty-brown colored tundra noted adjacent to pad. Extent of contamination appears to include southern portion of pad as well as other pad areas.|

Facility Common Name	Site Street	Site Street2	Site City	ZipCode	DEC File Number	Staff Name	Problem Statement
|Oilfield Service Company|	|Spine Road|	|Block 70, Lot 5B|	|Deadhorse|	|99734|	|300.38.034|	|Evans|	|Extensive area of the bottom gravels at an oil service pad contaminated with diesel, hydraulic fluid, and xylenes including nearby pond sediment. Lease area in use since at least 1983. Petroleum odors and sheens noted at various locations on the pad and contamination found at the surface as well as 5 feet below. Extent of contamination estimated to occur over a large portion of the pad.|
|Oilfield Service Company|	|DNR Lease Tr. 29, #400082|		|Deadhorse|	|99734|	|300.38.092|	|Sundet|	|DNR requested RP to conduct PA on site prior to lease transfer. Preliminary sampling revealed Cr and Pb concentrations exceeding TCLP limits. One drum was observed in tundra.|
|Property|	|Mile 1 Dennis Road|	|Corner of Dennis & Holmes|	|North Pole|	|99705|	|100.38.033|	|Conn|	|During a site inspection on 8/31/88 DEC noted approximately 35 barrels of what appeared to be waste oil abandoned at the site. Subsequent inspections (6/6/91) found ruptured and rusted barrels and old batteries, including solid waste articles. Site has history of waste water and drinking water violations. Extent of contamination and threat to human health unknown.|
|Radio Relay Station|	|1440 Pedro Dome Road|	|15 Miles NE of Fairbanks|	|Fairbanks (near|	|99701|	|100.38.106|	|Buck|	|Pedro Dome is a former military communication site (1958-1984) which is now being operated by a private company. PCB (Aroclor 1260) contamination near a water tank was found on 10/9/86. The suspected source are four oil-filled heating elements within the tank. Date of release unknown. Extent of contamination and possibility of PCB migration has not been determined. Site qualifies for cleanup under the DERP program and remediation is planned.|
|Radio Relay Station|	|Alaska Highway|	|Northway Junction|	|Northway|	|99764|	|170.38.027|	|Caillouet|	|Report of possible contamination of drinking water; possible petroleum, solvent, and heavy metal contamination. Site is near the old Fairbanks/Haines oil pipeline and is a former military site scheduled for cleanup under the DERP program. Quantities disposed, date of disposal, extent of contamination unknown.|
|Refinery|	|1100 H & H Lane|		|North Pole|	|99705|	|100.38.090|	|Bauer, D.|	|Very large but unknown amount of product leaked from above ground bolted storage tanks in late 70's and early 80's. Estimate of 275,000 gallons of petroleum product recovered with drawdown well recovery as of 8/90. Air strippers installed to treat groundwater in 9/88.|
|Road Right-of-Way|	|410 Driveway Street|		|Fairbanks|	|99707|	|102.38.005|	|Wiegers|	|Original complaint received in 1986 reported oil spills and soil contamination. Subsequent monitoring well and soil boring samples revealed a floating hydrocarbon layer on the water table and hydrocarbon contaminated soils. Extent of contamination and human health impact is still to be determined.|
|Salvage Yard|	|Bethany St. & Frontage Rd|		|Fairbanks|	|99701|	|100.23.025|	|Bauer, D.|	|Site of military bunker 1957 to 1961. Surplus/salvage site operated by present owner from 1978 to 1983. Gravel pit filled with miscellaneous solid waste, including an unknown number of barrels, in early 1970's. Barrel contents unknown. Crushed 5 gallon cans labeled "malathion" also present. Extent of contamination unknown. Some removal of materials in 1986. Contamination known to remain as of 12/89.|
|Service Station|	|Mile 175 Dalton Highway|		|Coldfoot|	|99701|	|330.38.002|	|Williams|	|Widespread oil, diesel, and gas contamination dating back several years. Burial of waste oil and batteries. Petroleum product film found in drinking water wells. Multiple burial sites. Spills in tank area and throughout property. Contamination to pond and stream surface waters.|

Attachment 9.B

Preliminary Investigations of Petroleum Spillage, Haines-Fairbanks Military Pipeline, Alaska (Rickard, W.E. and F. Deneke, 1972; Photographs Omitted).

SR 170



Special Report 170

PRELIMINARY INVESTIGATIONS OF PETROLEUM SPILLAGE, HAINES-FAIRBANKS MILITARY PIPELINE, ALASKA

Warren E. Rickard
and
Frederick Deneke

April 1972

CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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April 1972

PREPARED FOR
ARMY RESEARCH OFFICE, LIFE SCIENCES DIVISION
DA PROJECT 2N061102B71D
BY
CORPS OF ENGINEERS, U.S. ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY
HANOVER, NEW HAMPSHIRE

PREFACE

This report was prepared by Mr. Warren E. Rickard, Botanist, and Lt. Frederick Deneke, Forester, Earth Sciences Branch, Research Division, U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL).

The study was conducted as part of Project 2N061102B71D, *Effect on the Ecology and Biochemistry in Cold-dominated Environments of Oil Seepages and Spills*, sponsored by the Army Research Office, Life Sciences Division.

The investigation required a great deal of cooperation from personnel concerned with pipeline operations. For their excellent assistance the authors are indebted to the following: Lt. Col. Billy Spinks and Mr. Leo Krupa, Petroleum Distribution Office, Fort Richardson, Alaska; Mr. Harry Young and Mr. Ben Northcott, Haines Pumping Station; Mr. Roy Ebby, Blanchard River Pumping Station; Mr. Hans Anderson and Mr. Fred McLaughlin, Destruction Bay Pumping Station; Mr. Darrel Duensing, Donjek Pumping Station; and Mr. Jack Stalberg, Beaver Creek Pumping Station. Thanks are also extended to Captain Brent McCown, USA CRREL Alaska Field Station, Fairbanks, Alaska, for his assistance in coordinating the study with the personnel at the Petroleum Distribution Office at Fort Richardson.

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PRELIMINARY INVESTIGATIONS OF PETROLEUM SPILLAGE, HAINES-FAIRBANKS MILITARY PIPELINE, ALASKA

by

Warren E. Rickard and Frederick Deneke

Introduction

In conjunction with other research into the effects of oil spills on tundra terrestrial ecosystems, USA CRREL began observations of past cuts and breaks along the Haines-Fairbanks military pipeline. Since the pipeline was built in 1956, forty recorded spills have occurred along it. Spills of differing ages provide the opportunity to compare the effects of petroleum products on vegetation and microbial activity, and to determine the relative amounts of oil remaining in the soil. This is particularly important considering current environmental concern over the proposed Trans-Alaska Pipeline and potential spills.

Description of pipeline

As early as 1950 a recognizable, growing demand existed for military petroleum products north of the Alaska Range in interior Alaska. A pipeline was considered the best possible means for transporting these products, and the Fluor Corporation, Los Angeles, California, was given the task of pipeline design by the U.S. Army Corps of Engineers. Installation of the pipeline was completed in October of 1955 with the Army assuming responsibility for its operation and supervision at that time.

The Haines-Fairbanks pipeline, as it came to be called, originates in the deepwater port of Haines and traverses 626 surface miles through Canada and Alaska to its termination at Fairbanks (Fig. 1). The pipe is 8 inches in diameter and 0.280 inch thick. It can potentially hold 210,000 barrels of fuel with an estimated value of $1,500,000. For further details see Table I.

The primary fuels pumped through the line are:

Diesel fuel, grade DFA
Aircraft turbine and jet engine fuel, grade JP-4
Automotive combat gasoline, grade 95C
Aviation gasoline, grade 115/145.

The dispatching of products through the line is controlled from the Dispatch Division at Fort Richardson, Alaska. Through an elaborate telecommunications system all phases, including pumping pressure at individual pump stations, are monitored on a large display panel. In addition any combination of fuels can be transported through the pipe at one time by maintaining turbulent flow in the pipe. To maintain turbulent flow 450 bph (barrels per hour) must be pumped through the line. The maximum throughput of the line is 27,500 bpd (barrels per day) if all pumping stations are utilized. Table II lists the pumping stations.

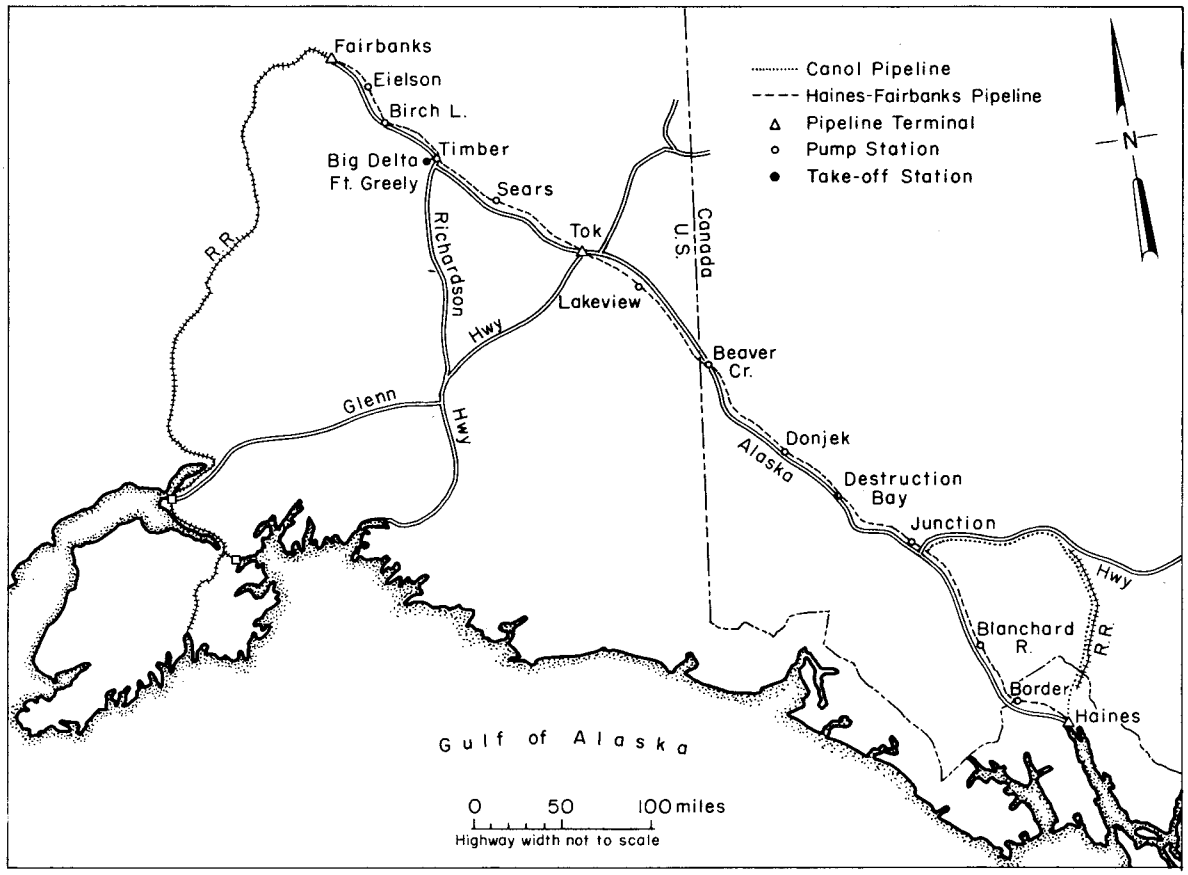

Figure 1. Pipeline route from Haines terminal to Fairbanks adjacent to the Haines and Alaska Highways.

Table I. Details of pipeline characteristics.

(From Pamphelt 360-1, *Haines-Fairbanks pipeline/ Whittier-Anchorage pipeline: General description of facilities.* Hq Petroleum Distribution Office, USARAL Support Command, December 1968.

Max discharge pressure	1440 psi	Trailers	60
Length	626 miles	Sets of quarters	52
Buried	148 miles	Permanent buildings	52
Aboveground	478 miles	Storage tanks (24 million gal)	52
Pump stations	12	Mainline valves 8 boxes	89
Major river crossings	25	Cost	$43,749,796
Major stream crossings	82	Cost per mile	$69,888
Highway crossings	49	Capacity (bpd)	27,000
Secondary road crossings	39	Capacity (gpd)	1,100,000
Major swamp and tundra areas	11	Profile range	30 to 3750 ft

Table II. Pumping stations.

Station	Distance (miles) Between stations	From Haines
Border Station	47	47
Blanchard River	40	87
Junction	71	158
Destruction Bay	51	209
Donjek	39	248
Beaver Creek	76	324
Lakeview	45	369
Tok	61	430
Sears Creek	54	484
Fort Greely	44	528
Timber	15	543
Birch Lake	26	569
Eielson	29	598
Fairbanks	28	626

1956 Pipeline fuel spills

Upon completion of pipeline construction in 1955 water was pumped into the line for hydrostatic testing. With all systems working satisfactorily the U.S. Army assumed command of the pipeline operations in October 1955. When petroleum was first introduced into the pipeline it would not pass through the pipe. It was discovered that the water used to test the line had not been completely removed and that it had frozen inside the pipe, blocking petroleum flow in several locations. In January 1956 the Army began efforts to determine the exact locations of the frozen sections. By maintaining a constant line pressure of 1000 psi near the origin of the pipe, pressure differentials could be noted at various locations, thus pinpointing blocked areas. When areas of low pressure were found the line was walked and tapped with a 10-lb hammer. A sharp ringing sound indicated a clear pipe, and a peculiar sound indicated the presence of ice in the line. When ice was located the pipe was cut and the loose end placed off to the side of the 50-foot-wide right of way. It was necessary to discharge the fuel off the right of way to eliminate fire hazard when the pipe was welded back together. In some instances attempts were made to construct catch basins but these proved impractical because of the frozen ground. The line was then purged and the fuel allowed to run out onto the frozen surface. The rate of flow from the open end varied, depending on the amount of ice in the pipe, but it was known to often exceed 500 bph. The exact amount of fuel loss cannot be assessed with any degree of accuracy. A rough estimate of the volume of ice removed is in excess of 500 yd^3, ranging from small fragments to full 8-inch-diameter pieces of varying lengths.

During the deicing operations 28 known cuts were made (Table III). The methods used in the deicing work were experimental. The main objectives were 1) clearing of the line as soon as possible, 2) conservation of the product, 3) protection of natural resources and 4) safety of personnel. Wherever possible, cuts were made away from civilization and with consideration given to watershed locations. In at least one instance the fuel was burned off, with smoke being visible for miles. This method was later discarded and the fuel was left to dissipate through the natural environment.

Table III. Location of pipeline cuts.

Cut no.	PLMP*	Date cut (1956)	Date purged (1956)	Highway mile access road
1	206.1	23 Jan	2 Feb	1074.9
2	203.6	24 Jan	31 Jan	1074.9
3	196.4	28 Jan	29 Jan	1066.0
4	195.8	29 Jan	29 Jan	1066.0
5	197.1	30 Jan	30 Jan	1066.6
6	205.0	1 Feb	2 Feb	1074.9
7	207.6	2 Feb	3 Feb	1082.5
8	208.2	3 Feb	4 Feb	1082.5
9	208.6	4 Feb	4 Feb	1082.5
10	217.1	9 Feb	9 Feb	1084.6
11	217.4	9 Feb	10 Feb	1084.6
12	253.0	16 Feb	17 Feb	1124.0
13	252.4	17 Feb	17 Feb	1124.0
14	233.2	18 Feb	18 Feb	1107.3
15	251.4	19 Feb	19 Feb	1124.0
16	253.4	21 Feb	21 Feb	1124.0
17	247.9	22 Feb	23 Feb	1124.0
18	236.0	22 Feb	22 Feb	1110.0
19	242.0	24 Feb	24 Feb	1117.0
20	268.0	25 Feb	25 Feb	1146.1
21	274.5	26 Feb	4 Mar	1152.0
22	264.8	28 Feb	26 Feb	1142.0
23	273.02	29 Feb	3 Mar	1148.0
24	268.9	1 Mar	1 Mar	1146.1
25	266.0	1 Mar	1 Mar	1143.6
26	256.8	2 Mar	2 Mar	1133.6
27	303.5	7 Mar	7 Mar	1182.0
28	382.5	16 Mar	16 Mar	1266.0

*PLMP = pipeline mile post

Other pipeline fuel spills

There have been twelve recorded ruptures in the pipeline since the events described above. Of the twelve, five are attributed to corrosion of the pipe. The remaining seven were caused by man (accidents and bullet holes). Table IV contains a record of dates and locations of breaks that have occurred.

1971 Reconnaissance trip

This section describes the spill areas investigated 14, 15 and 16 June 1971.

MP 1.9, 20 June 1968. External corrosion of the pipe caused a weak spot and under pressure a hole developed in the pipe resulting in fuel spraying 100 feet into the air and saturating the surrounding vegetation and soil. The spray was blown downwind for 100-120 feet. An estimated 100 barrels of jet fuel (JP-4) were lost. All vegetation the fuel came in contact with was killed, including hemlock (*Tsuga heterophylla*), spruce (*Picea glauca*) and balsam poplar (*Populus balsamifera*). A soil pit dug in the gravelly substratum in the middle of the kill area had a strong fuel odor down to the 50-cm depth. A small stream passing through the area had some oil film on the surface. Some new growth of woody plants was noted, and a few annuals were beginning to reestablish on the banks of the small stream.

Table IV. Pipeline breaks.

Time	Pipeline milepost locations	Cause	Loss
a. Spring 1956	33.5	Bullet hole	Unknown
b. 3 Nov 1964	3.0	Corrosion	Unknown
c. 15 Dec 1967	420.0	Vehicle hit valve	Unknown
d. Summer 1967	585.0	Power pole auger	Unknown
e. 17 May 1968	119.1	Corrosion	4,000 Bbl
f. 20 June 1968	1.9	Corrosion	100 Bbl
g. 14 July 1968	114.5	Bullet hole	200 Bbl
h. 22 July 1968	6.5	Corrosion	50 Bbl
i. 3 Dec 1968	17.7	Corrosion	800 Bbl
j. 18 May 1969	511.0	Bullet hole	Unknown
k. 12 June 1969	290.8	Bullet hole	100 Bbl
l. 28 Sep 1970	19.5	Corrosion	1,776 Bbl

MP 3.0, 3 November 1964. A rather large corrosion hole released JP-4 into a garden. The leak was first detected through the presence of fuel in a small drainage stream that runs through the area. The fuel was discharged into the stream and followed it through a residential area and on into the bay. There was no apparent damage to vegetation other than the garden and no fish kill was reported. The soil is highly organic. Currently a strawberry patch is growing over the location and no visible aftereffects were evident.

MP 3, 1956. A weld on a small bleeder valve gave way, causing a high pressure leak with slow loss of fuel. The pipeline is buried about 4 feet deep in this location and no evidence of fuel loss was noted on the surface. First indications of fuel loss came from a resident who reported an oily taste in water from a well located ¼ mile down the slope from the valve. No vegetation kill was ever reported and currently there is nothing visible that would indicate damage.

MP 6.5, 22 July 1968. This was a very small corrosion leak that occurred in a small drainage basin. The leak was first reported by a passerby who detected the odor. The pipe was buried at this location and the fuel apparently traveled down the valley, into a small stream and eventually into a large river. Repair crews excavated the pipe, repaired the leak, and reburied the pipe when finished. A soil pit in the valley center had a strong petroleum odor down to 60 cm in the fine-grained mineral soil. The surface is currently covered with a luxuriant growth of brome. Seven to ten small birch on the perimeter of the area were among the dead vegetation present, but it was not possible to distinguish if death occurred from the spill or from mechanical damage in excavating the pipe.

MP 17.7, 3 December 1968. A small corrosion leak in a buried portion of the pipe resulted in an estimated loss of 800 barrels. The pipe had to be excavated for a great distance before the high pressure leak could be found. Fuel soon filled the excavated trench and was subsequently pumped into a tank and burned off numerous times throughout the winter. Some large cottonwoods and alders in a nearby depression were killed back, apparently from the effects of the fuel. Currently two of ten large cottonwoods have a few leaves in some upper branches. In addition, a number of new branches are growing out from the bases of the alders. However, the interior of the stand was devoid of lower canopy vegetation whereas adjacent areas showed luxuriant growth.

MP 19.5, 28 September 1970. This rupture blew a large hole in the pipeline. An Alaska Highway Department employee came upon the break soon after it began and closed a valve that was within 300 feet of the break. The spillage flowed directly into a small mountain stream and into other river tributaries. Fisheries biologists found some fish kill and damage to spawning beds and bottom life. Vegetation along the stream appears to be undamaged.

MP 33.5, 1956. This break was caused by a bullet hole in the pipe where an aerial crossing occurs on Little Boulder Creek. Immediate loss of pressure led to quick detection of the break. The fuel flowed into the rapidly moving stream and apparently was dissipated. No reports of damage to aquatic or terrestrial habitats were made.

MP 114.5, 14 July 1968. A bullet hole caused by target practice produced this break. This location is beside a garbage dump on a north-facing 20° slope. The pipe was buried following the incident and the area was greatly disturbed so that no reliable indicators of vegetative damage exist. No vegetation is growing in the area.

MP 119.1, 17 May 1968. The initial spill area is located some 600-700 feet above the west banks of Dezadeash Lake, Yukon, Canada. This spill is considered by the pipeline personnel to be the most significant in the 15-year history of the pipeline, as an estimated 4000 barrels of diesel fuel were lost. Soils in the area are highly acid and corrosive and caused the weak spot and eventual leak to form in the pipe. Large quantities of fuel permeated down the slope and out into the lake before the leak was located. Strong prevailing winds scattered much fuel along the north shore of the lake five to six miles away. Straw was scattered over the water to absorb the fuel and was then collected and burned. On the slope below the pipe, trenches were dug to collect the fuel as it flowed down the slope. The fuel from the pits was pumped into barrels and burned. A small cleanup party was left at the site for months to clean up any fuel that appeared.

A complaint was recieved in late June 1970 that the shoreline where fuel had been collected was turning reddish brown. Immediate investigations and subsequent analysis of water and soil samples showed the color to be the result of iron oxides in the water and not from the diesel fuel spill.* As the water was especially low at the time the reddish color was particularly evident.

The current investigation revealed that all vegetation in the immediate area of the spill was dead. Some elevated microrelief in the area was apparently above the greatest oil concentration and had some moss cover growing on it. Soil pits at the bottom, middle and top of the slope all had strong odors of petroleum. At least one area was observed where fuel was seeping to the surface. Fishing has apparently returned to near normal on the lake since the significant fish kill reported at the time of the spill.

MP 197.1, 30 January 1956. This area is on a north- to northeast-facing steep slope with the pipe nearly ¼ mile from the bottom of the slope. The fuel was allowed to run down the slope when the line was cut for purging. All species of vegetation were killed at the time of the spill. Some grass is growing in an old Cat trail that traverses the area but very little other new vegetation is evident. A few small white spruce 6 to 12 inches tall are growing at scattered locations within the area. There is at least one area where the surface organic mat has been washed away leaving a small depression 10 to 12 feet in diameter. Other visible evidence of slope movement is present as 2- to 4-inch cracks which can be seen where the organic mat has pulled apart. Strong petroleum odors were found in all three soil pits placed on the slope. Some hummocks have moss and labrador tea growing on them within the area. The lower portion of the slope has been cleared for construction of a telephone line and several small white spruce are growing there.

*Tests conducted by FWQL, Portland, Oregon.

MP 207.6, 2 February 1956. This is a large area 200 feet wide near the pipe and forms an inverted V-shape 700-800 feet down a gentle slope. The area could be called a small watershed basin. Vegetation is completely lacking in the center of the main spill area. Three soil pits were placed in the kill area and on the fringe. Odors of petroleum were present in all three with the soil frozen at 20 cm.

MP 217.1, 9 February 1956. Spillage here was over an area 100 feet wide and 300 feet long on a very gentle slope. The soil appears to be very well drained. A fire had apparently covered the entire area prior to the spill as many fallen spruce were present. Areas outside the spill have good spruce and moss growth. Within the spill area a number of small spruce, labrador tea and other plants are growing. Of all the 1956 spill sites this one had the most abundant amount of vegetation.

MP 244.7, 1956. The exact date of this leak is unknown as a valve was left open by workmen when the line was being purged in 1956. An unknown quantity of JP-4 leaked out overnight into a small stream and over an area 100 feet wide by 400 feet long. Fish taken from the stream reportedly tasted of petroleum for 4 to 5 years after the spillage occurred. Currently vegetation appears to be doing quite well with willow, cottongrass, birch and moss growing over most of the area.

MP 256.8, 2 March 1956. Located on a slope, the kill area was within a small watershed. Appearance of the kill area leads to the conclusion that the fuel moved uphill on each side on the basin for 2 to 3 feet. Hummocks within the area have some spruce and willows growing on them.

MP 257.1, 1956. Same as above.

MP 268, 25 February 1956. The cut was made in a small flat area which is drained by a small stream. A soil pit at the edge of the drainage basin has a petroleum odor. A pit in the middle of the drainage area had 10-12 cm of organic matter on top with at least 2 feet of volcanic ash. No detectable odor was found here and a water sample was collected for analysis. Some spruce trees on the edge of the area were killed but a few small birch and spruce are returning.

MP 273.2, 29 February 1956. This is a rather large spill area at least 250 feet in diameter. The pipe was purged into a small drainage area on the 1-2° slope. All vegetation, of which black spruce predominates, was apparently killed at the time. The main drainage area now has vegetation growing in it. However, in those areas not directly in the drainage basin no vegetation has yet become established. A soil pit was placed in both living and dead areas.

MP 290.8, 12 June 1969. This leak was caused by a bullet that was intended for a bear in a garbage dump. The leakage progressed for 1 hour before pumping operations were stopped. The pipe in this area was buried following repair operations. As little vegetation was present prior to the spill no assessment of damage can be made. A strong odor is still present in the gravelly soil and no vegetation is growing in the area.

MP 382.5, 16 March 1956. Fuel spilled at this location was gasoline, called Mo Gas by the Petroleum Distribution Office. The site is on a very steep 40° south-facing slope. Soil is a well drained silt loam and contains a layer of fine volcanic ash. The spill killed aspen 4 to 6 inches in diameter and all the surface cover. Brumus, small aspen, fireweed and bearberry are growing at scattered locations within the area. Soil pits from mid-slope gave a strong odor of gasoline.

MP 511, 18 May 1969. This location is directly behind a scenic viewpoint at MP 1041 of the Alaska Highway. A bullet hole released an unknown amount of fuel. The pipeline has since been buried and no vegetation is growing over the disturbed area. The biggest scar left at this site is the ridge of surface material that was pushed back into the edge of the wooded area by a bulldozer.

Discussion

As has been indicated in the preceding section, methods used to evaluate the effects of petroleum spillage were both quantitative and qualitative. Originally a series of transects were planned for analysis of vegetation types growing both within and outside of spillage areas. However, after viewing the extent of dead vegetation and the time involved, this idea was abandoned. Instead qualitative observations were made as to types and locations of plants. Most areas had little or no evident vegetation regrowth even after the 15 years that had elapsed since the 1956 line cuts. New vegetation was growing within and adjacent to drainage pathways. Apparently growing conditions here had been improved by leaching of petroleum from the soil by runoff water.

Effects on woody vegetation can be seen by examining cross sections through the larger trees. Growth rings show a definite suppression in size (width) during the year spills occurred. A black spruce growing at the edge of the MP 207.6 1956 line cut has 15 years of very little growth. All growth rings since 1956 are very narrow, appearing as a band effect. Another sample of a hemlock from the rupture at MP 2 on 20 June 1968 has a very narrow growth ring with no "latewood" growth occurring during 1968. A third sample from near Dezadeash Lake shows suppressed growth following the spill. This sample also has an increase in the number of resin cells in this ring with considerable resin being exuded from the sample. This increase in resin cells is found quite often in trees subjected to fire. As the number of samples was quite small, definite conclusions cannot be made at this time. Further sampling should allow for the formulation of a definite hypothesis on the effect oil spills have on forest growth.

A series of soil samples were taken for laboratory analysis of petroleum content and microbial respiration. At the time of this writing analysis for petroleum content has been delayed as standard arctic diesel and aviation fuel samples have not arrived in the laboratory. Determination of respiration rates has begun and will take some time to complete due to the number of samples. The samples are being run on a Gilson respirometer using standard techniques. Depending on the weight per unit area of the sample 1 or 2 grams are placed into the respirometer flasks with a KOH solution placed into the center well. The flasks are placed on the respirometer and allowed to equilibrate, and then hourly readings are made of microliters of oxygen absorbed. Results are expressed as microliters per gram dry soil per hour. Preliminary results from the 1956 spill at mile 207.6 indicate a very slow rate of respiration in samples from the spill areas in contrast to control groups. Again definite conclusions can not be made until analyses of remaining samples are completed.

The fact that vegetative growth has been depressed or absent over the 15-year period is somewhat surprising. First thoughts on the matter lead to the conclusion that all of the active petroleum products should be decomposed or leached from the soil by this time. Quite apparently this has not occurred. To find reasons for this phenomenon a review was made of the military specifications of the fuel spilled from the pipeline. Thoughts were that possibly some additives had been placed into the fuel to prevent microbial growth. From form VV-F-800a, dated 22 May 1968, the only additive in diesel fuel is cetaine which is for the improvement of engine performance. No apparent antimicrobial agents are present in this fuel.

For examination of aircraft turbine and jet engine fuels used in 1956, Mil-F-5624B dated 7 December 1953 was consulted.* The JP-4 fuels are low vapor pressure, wide-cut gasoline type fuels. Among inhibitors in 1953 were the following:

(a) 2, 6-ditertiary butyl-4-methyl phenol
(b) N, N' disecondary butyl-para-phenylenediamine
(c) 2, 4-dimethyl-6-tertiary-butyl phenol.

*Copies of military specification material were supplied by Mr. Richard Horton, Quality Surveillance, Army Materiel Command, Washington, D.C.

These were added in a total concentration not to exceed 1.0 pound of inhibitor per 5000 U.S. gallons of fuel for the prevention of gum formation. It is possible that these concentrations of inhibitors could be responsible for the lack of vegetation growing on the spill areas. As of 30 October 1970 the list of antioxidants in JP-4 has grown to nine (Mil-T-5624H). The current concentrations are 9.1 g/100 gal (U.S.), 24 mg/liter or 109 mg/gal (U.K.) for gum prevention. More detailed analysis may be required to determine which, if any, compounds are still present in the soil.

Another factor that may have some influence on the presence of the petroleum in the soil is the degree of solubility in water of the petroleum. Among requirements for the JP-4 is one that states "JP-4 fuel shall separate sharply from the water layer, and there shall be no evidence of an emulsion or precipitate within or upon either layer." As the pipeline does lie in the subarctic, precipitation and temperatures are quite low. Because the fuel is not soluble in water and because of the lack of precipitation, leaching of chemicals from this soil is very slow. This also could substantiate the fact that some vegetation has been able to grow in drainage basins within the fuel spills where larger volumes of runoff occur.